AMENDMENTS TO THE DRAWINGS

The attached annotated sheet of drawings includes changes to FIG. 3. That sheet, which includes FIG. 3, replaces the original sheet including FIG. 3. In the annotated sheet, the solid black shading is replaced by cross-hatching. A replacement sheet is being prepared by a competent draftsman and will be filed with the Patent Office in due course.

Attachment: Annotated Sheet Showing Changes

REMARKS

This Amendment is in response to the Office Action mailed March 13, 2007. The Examiner set a shortened statutory period for reply of three (3) months, making the present Amendment due by June 13, 2007. Accompanying this amendment is a Petition for a one-month extension of time and appropriate fee, making this amendment due on July 13, 2007.

In the present paper, claims 1, 2 and 5-7 have been amended, claims 21-24 have been added and claims 4 and 11-14 have been canceled. Claims 1-3, 5-10 and 15-24 are presented for the Examiner's consideration.

The Drawings

The Examiner has objected to the drawings because solid black shading is used in FIG. 3. Applicant has appended hereto an annotated sheet showing changes to be made to FIG. 3. Specifically, solid black shading is to be removed, and replaced by hatching in compliance with 37 C.F.R. § 1.84(h)(3). Applicant has ordered replacement formal drawings from a draftsman and will file those drawings with the Patent Office when they become available.

Claim Rejections

The present invention is directed to a technique for active vibration reduction by inducing anti-phase vibrations in a pump. Vibrations originating outside a pump, such as vibrations from a backing pump, are reduced by inducing anti-phase vibrations in the pump. The anti-phase vibrations may be induced using active magnetic bearings in the pump.

Each of the independent claims in the present case is now directed to the reduction of vibration originating *outside* a pump by producing a vibration *within* that pump. For example, exemplary new claim 21 claims a method of actively reducing vibration of a backing pump in a pumped system. A vibration of the backing pump is measured at location remote from the backing pump. A control signal is generated in response to the vibration of the backing pump. That control signal is sent to a magnetic bearing in a primary pump to induce a cancelling vibration in the primary pump. The cancelling vibration is in opposition to the vibration of the backing pump such that a sum of the vibration of the backing pump and the cancelling vibration is less than the vibration of the backing pump.

In the Office Action, the Examiner has rejected claims 1, 2, 5-8 and 11-14 under 35 U.S.C. § 102(b) as being anticipated by Japanese Patent Publication No. JP 2004-147454 to Toshiaki ("Toshiaki"), has rejected claims 3, 9 and 10 under 35 U.S.C. § 103(a) as unpatentable over Toshiaki, and has rejected claims 1, 4 and 15-20 under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent No. 7,033,142 to Conrad ("Conrad") in view of Toshiaki.

The Toshiaki reference describes a technique for reducing vibration in a place separated by some extent from a magnetic bearing in a rotating machine with an active magnetic bearing device (English Abstract). Toshiaki notes that vibration from a turbomolecular pump was previously controlled using oscillation detectors within the active magnetic bearings (Toshiaki at para. [0003]). That technique was not effective in controlling vibrations induced by the turbomolecular pump at locations remote from the pump (paras. [0003]-[0004]).

To solve that problem, Toshiaki places sway sensors 27a, 27b on a flange 38, at the location where it is desired to reduce vibration (FIG. 13; para. [0029]). The active magnetic bearings of the turbomolecular pump are then controlled, using measurements from the sensors, to reduce vibration from the turbomolecular pump at the measurement location (para. [0006]).

Toshiaki thus controls the active magnetic bearings of the turbmolecular pump to reduce vibrations originating in the turbomolecular pump. Toshiaki nowhere considers any approach to reducing vibrations originating from outside the pump containing the active magnetic bearings.

Conrad describes a vacuum pump system wherein at least one intermediate pump is inserted between a high-vacuum pump and a backing pump, to increase the compression and suction capacity in the fore-vacuum region (Conrad, col. 1, line 58 – col. 2, line 3). The intermediate pump is directly connected, without large conductance losses, to the outlet of the high-vacuum pump (id.).

Conrad does not discuss active magnetic bearings. There is no mention of vibration sensors anywhere in Conrad. Conrad does not address or even suggest a problem with vibration in a vacuum pumping system.

Claims 1-3, 5 & 6

Claim 1 claims a method including measuring a first vibration in a first pump, and producing a second vibration in the pump that is an anti-phase of the first vibration. Claim 1 has

been amended to incorporate the limitations of claim 4, requiring that the measured vibration be generated by a second pump that is connected to the first pump.

In rejecting former claim 4, which contained the limitations now in claim 1, the Examiner stated that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Conrad with Toshiaki in order to negate any undesirable vibration."

To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. M.P.E.P. § 2143.03 (citing In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)). Applicant respectfully submits that the combination of Conrad and Toshiaki does not teach or suggest the reduction of vibrations from a second pump by producing anti-phase vibrations in a first pump. Instead, Toshiaki, the only reference addressing a vibration problem, teaches producing anti-phase vibrations in a pump to counter unwanted vibrations *produced within the same pump.*

Put another way, to apply the technique of Toshiaki to reduce vibration produced by a particular pump, the anti-phase vibration would be produced in that same pump. That solution would be of limited value in reducing backing pump vibrations because the backing pump does not have active magnetic bearings with which to produce an anti-phase vibration.

The inventor has discovered a technique for reducing vibration generated by one pump by producing an anti-phase vibration in another pump. That technique is particularly useful in cases where the pump producing the unwanted vibration has no active bearings or other vibration-synthesizing means. Neither Conrad nor Toshiaki, taken alone or in combination, suggest such a technique.

Applicant therefore submits that claim 1, together with dependent claims 2, 3, 5 and 6, which incorporate the limitations of the independent claim, are patentable.

Claims 7-10

Claim 7 has been amended to require that the measured first vibration originate outside the pump. A control signal is generated in response to the first vibration, and sent to a magnetic bearing in the pump.

For the reasons stated above with reference to claims 1-3, 5 & 6, Applicant submits that amended independent claim 7 is patentable over the combination of Conrad and Toshiaki. There is no teaching or suggestion in those references, individually or in combination, to generate and

send to a magnetic bearing in a pump, a control signal to induce a vibration in opposition to a vibration originating outside the pump.

Applicant therefore asserts that independent claim 7, together with dependent claims 8-10, are patentable for at least that reason.

Claims 15-20

Original claim 15 is directed to a system containing a first pump and a second pump. The first pump produces a first vibration. A control circuit sends a signal to a magnetic bearing in the second pump in response to the first vibration, to induce a second vibration in the second pump.

For the same reasons stated above with reference to claim 1, the combination cited by the Examiner does not teach or suggest the two-pump system of claim 15 wherein a signal is sent to magnetic bearings in a second pump to induce a second vibration in response to a first vibration produced by a first pump. Applicant therefore submits that claims 15-20 are patentable over the combination made by the Examiner.

Claims 21-24

New claim 21 is a method of actively reducing vibration of a backing pump in a pumped system. Vibration of the backing pump is measured at a location remote from the backing pump. In response to that vibration, a control signal is generated and sent to magnetic bearings in a primary pump to induce a canceling vibration.

New claim 21 is directed to a particular embodiment described in the present specification. Because a typical backing pump has no active bearings, the arrangement of Toshiaki cannot be used to reduce vibration originating from the backing pump. That is because Toshiaki teaches the use of active magnetic bearings to reduce vibration in the same pump from which the vibration originates. The inventors have shown that the active bearings in the adjacent primary pump may be used to induce anti-phase vibrations to reduce vibration from the backing pump.

Applicant therefore asserts that new independent claim 21, together with dependent claims 22-24, which incorporate its limitations, are patentable over the cited art.

Conclusion

Applicant therefore asserts that pending claims 1-3, 5-10 and 15-24 are in condition for allowance, and earnestly requests that the Examiner issue a Notice of Allowance.

Should the Examiner have any questions regarding the present case, the Examiner should not hesitate in contacting the undersigned at the number provided below.

Respectfully submitted,

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Black shading to be removed
and hatching to be added to show cross section

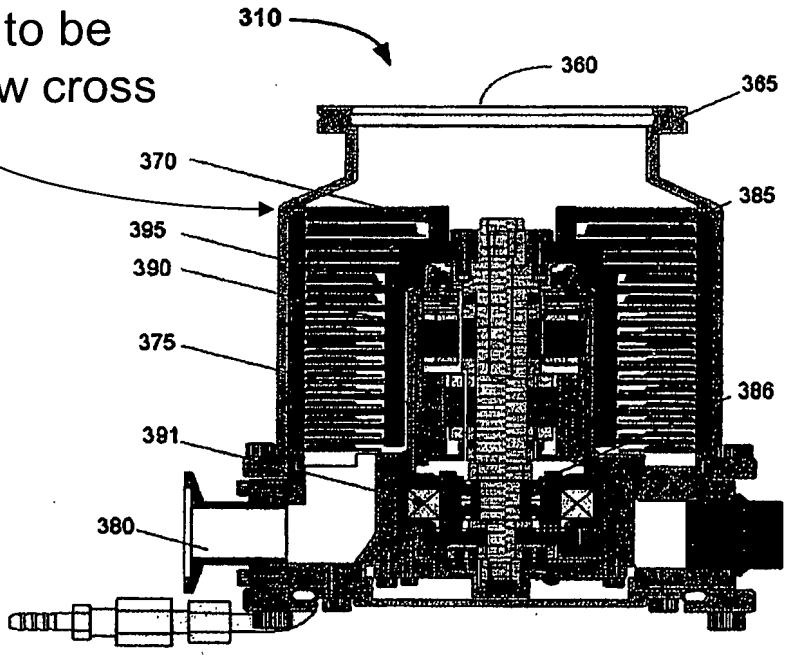

FIG. 3